

MIL-U-18033F(SHIPS)
20 November 1962
SUPERSEDING
MIL-U-18033E(SHIPS)
20 July 1962

MILITARY SPECIFICATION
UNDERWATER LOG EQUIPMENT,
ELECTROMAGNETIC TYPE

1. SCOPE

1.1 This specification covers electromagnetic underwater log equipment for use on Naval ships. This equipment provides a means of measuring, indicating, and transmitting ships' speed and distance relative to the water.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids form a part of this specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

QQ-N-286 - Nickel-Copper-Aluminum Alloy, Wrought (K-Monel).

MILITARY

- | | |
|--------------|---|
| MIL-I-983 | - Interior Communication Equipment, Naval Shipboard; Basic Design Requirements for. |
| MIL-C-3855/2 | - Connector, Plug, Electrical, Series Twin, Type UG-422-U. |
| MIL-Q-9858 | - Quality Control System Requirements. |
| MIL-B-16033 | - Bronze, Aluminum; Castings. |
| MIL-I-16923 | - Insulation Compound, Electrical, Embedding. |
| MIL-E-17555 | - Electronic and Electrical Equipment and Associated Repair Parts, Preparation for Delivery of. |
| MIL-S-20708 | - Synchros, 60 and 400 Cycle, General Specification. |
| MIL-E-22843 | - Equipment, Low Noise Level (Naval Shipboard Use). |

STANDARDS

MILITARY

- | | |
|-------------|--|
| MIL-STD-271 | - Nondestructive Testing Requirements for Metals. |
| MIL-STD-278 | - Welding and Allied Processes for Machinery for Ships of the U.S. Navy. |
| MIL-STD-710 | - Synchros, 60 and 400 Cycle. |
| MS 3102 | - Connector, Receptacle, Electric, Box Mounting. |

DRAWINGS

BUREAU OF SHIPS

- | | |
|------------------|--|
| 9000-S6504-73687 | - Dial Markings for Interior Communication Telegraph and Indicating Systems. |
| 3,304,063 | - Underwater Log Equipment (Electromagnetic Type)- Sea Valve and Packing Assembly. |
| 3,315,217 | - Underwater Log Equipment (Electromagnetic Type)- Rodmeter Assembly. |

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

FSC 6320.

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2.2 Other publications.- The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)
B148-Specification for Aluminum Bronze Sand Castings.

OFFICIAL CLASSIFICATION COMMITTEE
Uniform Freight Classification Rules

(Application for copies should be addressed to Official Classification Committee, 1 Park Avenue at 33rd Street, New York 16, New York.)

3. REQUIREMENTS

3.1 Preproduction sample.- Prior to production, one preproduction sample and three additional rod meters shall be tested as specified in 4.3 and 4.3.1.

3.2 Description.-

3.2.1 General description.- This equipment shall provide a means of measuring the speed of a ship with respect to water, by application of the electromagnetic principle, and shall indicate and transmit, by synchro transmission, speed information to remote stations. The equipment shall be a full scale speed of 40 knots, and shall be capable of measuring and indicating up to and including this speed, unless otherwise specified in the contract or order. In addition, this equipment shall convert the speed signal to distance and indicate and transmit, by synchro transmission, distance information to remote stations. Unless otherwise specified (see 6.1) one complete system shall consist of the following components:

- (a) Two rod-meters (one for replacement purposes).
- (b) One indicator-transmitter (includes amplifier).
- (c) One sea valve assembly.
- (d) One set onboard repair parts.
- (e) Two manufacturer's manuals.
- (f) One remote dummy log speed control unit.

3.2.2 Description of principle.- The electromagnetic underwater log consists essentially of a rod-meter and indicator-transmitter. The rod-meter protrudes below the hull of the vessel approximately 30 inches and contains the sensing element. This sensing element consists of an electromagnet, imbedded in insulating compound, which sets up a magnetic field in the water surrounding the rod-meter. This coil is energized by ship's 60-cycle power. As the ship moves forward, the water passes the rod-meter and cuts the lines of magnetic flux, thus generating a voltage in the water. Two electrodes, flush with the surface of the rod-meter, pick up this voltage which is applied to the input of the amplifier. A component of this voltage is directly proportional to speed, except for slight nonlinear effects caused by turbulent water flow around the rod-meter. Circuits shall be incorporated in the amplifier to filter out all voltages except those of the proper phase relationship which represent actual speed signals.

3.3 General features.- The equipment shall be in accordance with the following paragraphs of MIL-I-983 in addition to the requirements specified herein: (Whenever a requirement of MIL-I-983 conflicts with a requirement of this specification, the requirement of this specification, shall govern.)

General requirements
Materials, general
Substitution of (equal or superior) materials
Fungus-inert materials
Unacceptable materials
Flammable materials
Arc - resistant materials
Toxic materials
Wood

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Metals
 Aluminum
 Magnesium
 Iron and steel
 Zinc
 Springs (material)
 Other metals
 Plastics
 Mechanical parts
 Lubricants and lubrication
 Painting
 Protection against corrosion
 Bolts, machine screws, studs and nuts
 Gaskets
 Dials and pointers
 Dial sizes
 Locking devices
 Washers
 Ball bearings
 Parts - electrical - general
 Requirements for semiconductor devices
 Electron tube or capacitor sockets
 Capacitors
 Variable resistors
 Transformers
 Relays
 Synchros
 Electrical tapes
 Batteries
 Dial illumination lamps
 Switches
 Indicator lights and lampholders
 Metallic rectifiers
 Printed wiring and circuits
 Enclosures - general
 Enclosure - accessibility
 Enclosure - degree of
 Enclosure mounting
 Stiffening grooves
 Minimum sheet metal thickness
 Through bolting
 Cable entrance
 Ventilation
 Size (for submarines)
 Threaded devices
 Rounded corners and edges
 Internal subassembly protection
 Drilled and tapped holes
 Welding
 Temperature and humidity (rod meter shall be tested to + 20° F.)
 Accelerated life
 Depth charge
 Shock, vibration and inclination (see 3.3.5)
 Primary power supply circuits
 Power supply tolerances (normal power supply 115 volts, 60 cycles, single phase, a.c.) (see 3.3.2)
 Personnel protection
 Shielding and radio frequency noise reduction
 Ground potential and grounding

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Soldering
 Electrical parts mounting
 Internal subassembly connection
 Terminal boards, connectors and terminals
 Synchro connections and markings
 Wiring
 Dielectric strength and insulation resistance clearances
 Airborne noise (see 3.3.1)
 Structure borne noise (see 3.3.1)
 Drawings - general
 Drawings - preliminary
 Drawings - working
 Schematic diagrams
 Wiring diagram
 Drawing list
 Assembly drawings
 Drawings - manufacturing
 Bill of materials
 Interchangeability and standardization
 Manuals (type I)
 Reports
 Workmanship and general examination

3.3.1 Airborne and structureborne noise. - Equipment shall conform to grade C of MIL-E-22843.

3.3.2 Power supplies. - The equipment shall be designed such that it can operate solely from normal power supply (see 3.3).

3.3.3 The performance of the equipment shall be independent of changes in resistivity of water and shall, without adjustments, satisfactorily meet the accuracy requirements specified herein, when tested in water having a resistivity of from 20 to 200 ohms per cubic centimeter.

3.3.4 Underwater elements, or elements of the equipment subject to hydraulic pressure, shall be designed to withstand 750 pounds per square inch (p.s.i.) hydrostatic working pressure for 1 hour without leakage, deformation, or operational failure. Also, these elements shall withstand a test pressure of 1500 p.s.i. for 10 minutes, and the depth charge test specified in MIL-I-983. In addition, each element shall withstand a long time loading of 200 p.s.i. for 48 hours continuously without leaking, deforming, or otherwise becoming inoperative.

3.3.5 Shock and vibration. - The equipment shall be class HI shockproof in accordance with MIL-I-983, and shall meet the vibration requirements for vital equipment without the use of shock or vibration mounts. Vibration isolators may be used to mount the electronic chassis in the amplifier unit.

3.3.6 Detail manufacturing drawings shall include all dimensions and tolerances and shall completely identify stock items and include the source of supply. The center of gravity and accurate weight of equipment shall be shown on the installation drawing. All drawings shall be suitable for microfilming.

3.4 Performance tolerances. -

3.4.1 The system shall measure and indicate simultaneously the true water speed and true water distance traveled and position the corresponding transmitting synchros within the following tolerances, when tested in a calibration towing tank satisfactory to the bureau or agency concerned.

3.4.1.1 Speed indication. - The speed indication accuracy shall be within 0.05 knot of true speed from zero to full scale. Oscillation of the 0 to 1 knot speed pointer due to "hunting" of speed servo shall not exceed plus or minus 0.005 knot.

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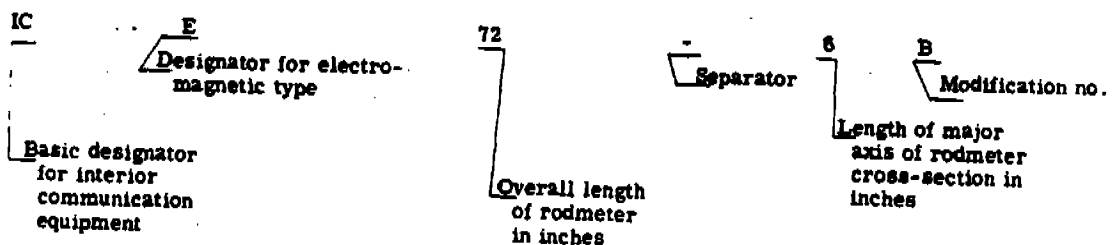
3.4.1.2 Speed indication response rate.- With full scale signal applied to the amplifier and the speed indicator initially at 0, full scale indication shall be obtained in 60 ± 10 seconds when the speed servo is running at normal rate, and $5 \pm 1/2$ minutes when running at slow rate.

3.4.1.3 Distance indication.- The error of conversion from speed to distance from 0.5 knot to full scale shall not exceed 1 percent of the distance traveled.

3.4.1.4 Distance indication response rate.- The distance indication within the tolerances specified in 3.4.1.3 shall not lag the speed indication by more than 10 seconds.

3.5 Detail requirements.-

3.5.1 Rodmeters.- Rodmeters shall be of the types designated in the following form, as specified (see 6.1):



Standard lengths for rodmeters shall be 72 and 100 inches. The contour of the rodmeter shall be in strict accordance with that shown on Drawing 3,315,217. Herringbone on the sensing element shall be eliminated. The top portion shall consist of a detachable watertight terminal box not over 5 inches in diameter, which will accommodate the two cable connectors for the cable from the rodmeter to the indicator-transmitter. The cover of this box shall be of sufficient strength to act as a positive stop against a bearing surface secured to the structure of the ship to prevent the rodmeter from being forced out of the seavalue extension. This box shall be removable such that the rodmeter can be ejected outboard from the ship, if necessary. The box shall be rotatable through 180 degrees in either direction, and shall be equipped with two 90-degree twinax connectors facing upward through which connections to the pickup plates and electromagnet shall be made. The main body of the rodmeter shall be constructed of nickel-copper alloy, class A, in accordance with QQ-N-286 and provide a working strength of at least 65,000 p.s.i. in the outer fibers. The lower 12 to 13 inches of the rodmeter which contains the sensing element, shall be fabricated from a type C plastic embedding compound in accordance with MIL-I-16923. The shell of this plastic section shall be reinforced with a suitable glass fabric or glass rovings. The rodmeter shall be designed so as to reduce to a minimum, the tendency to foul from seaweed and marine growth, and the necessity for withdrawal for repairs or cleaning. The rodmeter shall not bend or twist, when in maximum extended position, when used at the maximum speed and depth for which the equipment is designed. The embedded sensing element shall consist of an electromagnet having an impedance such that 750 ± 5 percent milliamperes flow through the coil when energized at 50 volts at 60 c.p.s. Under these operating conditions the rodmeter speed signal sensitivity, when measured at the pick-up buttons, shall be 325 ± 5 percent microvolts per knot. Quadrature or transformer voltage shall not exceed 50 microvolts. The pick-up plates in the sensing element of the rodmeter shall be constructed of material identical to that in the main body of the rodmeter, and shall be approximately 3.8 inch in diameter. Throughout the speed range of 0 to 40 knots, the rodmeter shall not cavitate when operating in water at a depth of 3 feet.

3.5.2 Indicator-transmitter.- The indicator-transmitter shall be of drip-proof construction designed for bulkhead mounting, and shall have overall and mounting dimensions and cable connections shown on Figure 1. The indicator-transmitter shall be designed so that the internal units can be removed from the case or hinged to permit maintenance without disturbing the ship's wiring. Component subassemblies such as magnetic amplifiers shall be repairable and shall not be potted. Solid state devices shall be protected against transients of 3 milliseconds duration and 7 times their rated voltages. Adequate heat transfer provisions shall be made to permit full operation in ambient temperatures up through 149°F . Speed shall be indicated on a dial in accordance with figure 29 of Drawing 9000-S6504-73687, except that the dial diameter

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shall be 6-3/4 inches. Distance shall be indicated by means of a six-digit counter from 0000.00 to 9999.99 nautical miles; the first four numerals shall be white on dull black background; the last two numerals (tenth and hundredths) shall be black on dull white background. Digits on the distance counter shall be at least 1/4 inch high. These indications shall be visible through windows in the cover of the unit. The indicator-transmitter shall be designated type IT-C and shall comprise:

- (a) A potentiometer feedback type servo system which shall convert the rod-meter speed voltage signal to visual indications of speed, and which shall position one type 31TX6 to operate synchro repeaters at 40 knots per revolution, one type 18CX6 to transmit a speed signal of 100 knots per revolution, and three type 1' CX4 synchros to transmit speed signals of 10, 40, and 100 knots per revolution to control transformers in navigation and fire control systems. The potentiometer shall be a dry, long life, precision type. The speed servo shall incorporate a device to permit changing the output response time from zero to full scale in 1 minute \pm 10 seconds to zero to full scale in 5 minutes \pm 30 seconds and vice versa. Also, the speed servo shall incorporate a hand crank to permit hand positioning the speed servo to any speed throughout the range 0 to 40 knots.
- (b) A mechanical integrator and a servo system which will convert the above speed indications to visual indications of distance traveled in nautical miles (6076.10 feet/mile), and rotate a type 31TX6 synchro at the rate of 360 revolutions per nautical mile. The distance transmitting synchro shall not be driven directly from the roller and disc mechanism.
- (c) Devices that can be adjusted to correct for errors, both constant and variable with speed, which may be caused by flow characteristics in the region of the rod-meter sensing element. This shall consist of nine devices which will compensate plus or minus 0.40 knot at 4., 8., 12., 16., 20., 24., 28., 32., and 36 knot scale positions independently and without interaction with each other. In addition, a device shall be provided to compensate plus or minus 1 knot for error indications at zero speed and a scale factor adjustment which can adjust the scale factor plus or minus 4 knots. Accuracy between dial calibration and correction entered shall be \pm 1.0 percent.
- (d) A dummy signal circuit which can supply speed signals in lieu of the rod-meter to check system operation continuously from 0 to 40 knots. Provision shall be made whereby the dummy signal circuit can be remotely operated. The remote dummy log speed control unit shall be enclosed, and shall contain lamps to indicate when the unit is connected to control the speed indicated.
- (e) An amplifier unit as specified in 3.5.3.
- (f) All synchro transmitters and control transformers shall be in accordance with MIL-S-20708 and MIL-STD-710.

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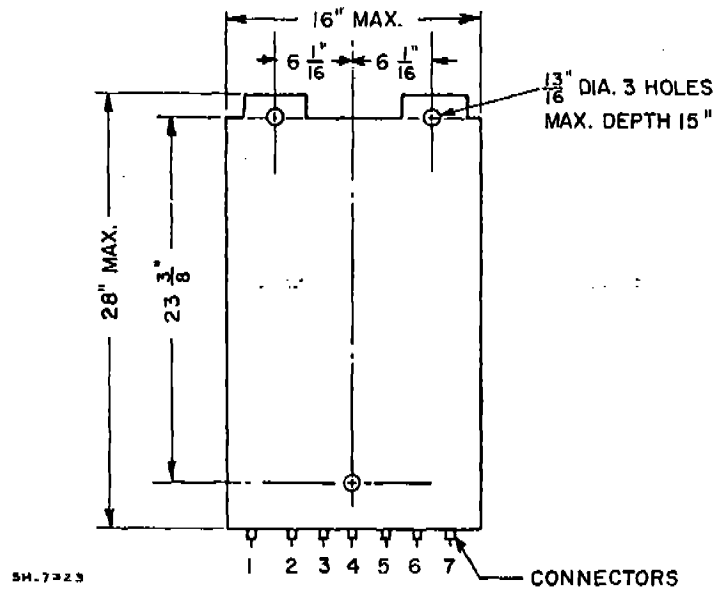


Figure 1-Mounting dimensions and cable connections

No	Unit	Specification	Pin connections							Key	
			Synchro leads			S & D		RCU	Coil	Plates	Position
			R1	R2	S1	S2	S3				
1	Rodmeter	MIL-C-3655/2							1 2		X
2	Rodmeter	MIL-C-3655/2								1 2	Y
3	Power 60 cycles	MS3102 R12S-3P						A B			Normal
4	Power 400 cy	MS3102 R12S-3P	A	B							W
5	Speed (400 cy)										
	10K/rev.				A	B	C				
	40K/rev.	MS3102			D	E	F				
6	100K/rev.	R18-1S			G	H	I				Normal
	Speed (60 cy)										
	40K/rev.				A	B	C				
7	100K/rev.	MS3102			D	E	F				
	Distance	R18-1S			G	H	I				W
	Remote	MS3102						ABC			
	Control Unit	R16S-1S						DEF			Normal

Notes:

- 1/- S & D denotes speed and distance servo; RCU denotes remote control unit.
 2/- Mounting holes shall be accessible without removing cover.

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3.5.3 Amplifier. - The amplifier shall be contained in the indicator-transmitter enclosure. This unit shall comprise:

- (a) A circuit which will discriminate and separate that portion of the signal voltage which is proportional to velocity from quadrature and other stray voltages not associated with velocity. Output speed indication shall be less than 0.1 knot when 325 microvolts quadrature (with respect to speed) signal is applied at the rod-meter buttons.
- (b) A speed error signal voltage amplifier which shall be transistorized. Unpotted repairable plug-in circuit card or modules shall be utilized in the design of the amplifier. The power supply section shall be sufficiently shielded, electrically, from the remainder of the unit to insure that extraneous voltages are not transmitted to the low level signal circuits.

3.5.4 Seavalue assembly. - The seavalue assembly shall consist of a valve, a rod-meter packing or sealing gland, and a hull fitting or flange in accordance with Drawing 3,304,063. The main body of the seavalue shall be cast of aluminum bronze in accordance with class 4 (heat treated) of MIL-B-16033 or Publication ASTM B148, Alloy 9D. Repair of castings shall be in accordance with MIL-STD-278. The top cover piece for the rod-meter packing gland shall have a 3-inch cup-well designed to hold the rod-meter in alignment for passing into the packing gland, and to permit a small "alarm" stream of water to squirt up if a broken rod-meter should be withdrawn beyond the packing gland when the valve gate is still open. The hull fitting or flange shall be similar to the hull bearing specified herein, having a "cutlass" type bearing to cushion the rod-meter at the hull line. For submarine application, an additional fitting, a hull bearing (see 6.1), shall be furnished. This bearing shall be of the "cutlass" bearing type, and shall be generally in accordance with Drawing 3,304,063. The seavalue, both opened and closed, shall withstand for 1 hour without leakage, deformation, or operational failure, an hydraulic pressure of 750 p.s.i. When both opened and closed the valve shall withstand a test pressure of 1500 p.s.i. In addition, the valve shall withstand the simulated depth charge test outlined in MIL-I-983. The sea valve shall be designated type SV-C. Each valve including the hull fitting shall be radiographed in accordance with MIL-STD-271. The valve shall have a by-pass feature to bleed pressure around the gate permitting unaided opening at full test pressure.

3.5.5 Onboard repair parts. - The following items, if incorporated in the equipment, shall be furnished as onboard repair parts:

Name	Quantity
Bearings	For critical bearings only, one of each type and size, except where bearings are replaced in sets. Under such circumstances, one set of each type and size shall be supplied.
Seavalue packing for rod-meter	One set.
Cable connectors	One of each type and size.
Rod-meter ejector adapter	Two
Electronic circuit plug-in units	One complete set.
Precision and special resistors	One of each type and size.

4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Quality control system. - The contractor shall provide and maintain a quality control system acceptable to the Government for supplies covered by this specification. The system of quality control shall be in accordance with MIL-Q-9858.

4.3 Preproduction inspection. - A preproduction or first production unit of the equipment shall be subjected to the following preproduction inspection. Tests shall be performed in the order listed.

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<u>Inspection</u>	<u>Requirement paragraph</u>	<u>Test paragraph</u>
General examination	3.3	4.6.1
Accuracy	3.4	4.6.2.1
Speed of response	3.4 and 3.5.2(a)	4.6.1
Supply line voltage and frequency variation	3.3	MIL-I-983
Radio frequency noise interference	3.3 and 3.3.1	MIL-I-983
Airborne noise	3.3 and 3.3.1	MIL-I-983
Structureborne noise	3.3	MIL-I-983
Temperature and humidity	3.3	MIL-I-983
Inclination	3.3	MIL-I-983
Accelerated life	3.3	MIL-I-983 and 4.6.3
Dielectric strength	3.3	MIL-I-983
Insulation resistance	3.3	MIL-I-983
Enclosure	3.3	MIL-I-983
Vibration	3.3 and 3.3.5	MIL-I-983
Shock	3.3 and 3.3.5	MIL-I-983
Depth charge	3.3	MIL-I-983
Hydrostatic pressure	3.3.4 and 3.5.4	4.6.1

4.3.1 In addition, four sample rodimeters shall be tested at a water channel or towing basin facility satisfactory to the bureau or agency concerned to determine conformance with 3.5.1.

4.4 Quality conformance inspection. - The number of equipments specified in 4.4.1.1, 4.4.1.2, and 4.4.1.3 shall be subjected to the following group A and group B examination and tests and, when required, the group C tests. Tests shall be performed in general in the order listed.

<u>Inspection</u>	<u>Requirement paragraph</u>	<u>Test paragraph</u>
<u>Group A</u>		
Accuracy	3.4	4.6.2.2
Speed of response	3.4 and 3.5.2(a)	4.6.1
General examination	3.3	4.6.1
Dielectric strength	3.3	MIL-I-983
Insulation resistance	3.3	MIL-I-983
Working hydrostatic pressure (750 p.s.i. and 1500 p.s.i.) (valves and rodimeters only)	3.3.4	4.6.1
Structureborne noise	3.3	MIL-I-983
Radiograph seawalves	3.5.4	MIL-STD-271
<u>Group B</u>		
Hydrostatic pressure (200 p.s.i. for 48 hours) (valves and rodimeters)	3.3.4	4.6.1
<u>Group C</u>		
Radio frequency noise interference	3.3	MIL-I-983
Enclosure	3.3	MIL-I-983
Airborne noise	3.3 and 3.3.1	MIL-I-983
Temperature and humidity	3.3	MIL-I-983
Inclination	3.3	MIL-I-983
Accelerated life	3.3	MIL-I-983 and 4.6.3
Vibration	3.3	MIL-I-983
Shock	3.3	MIL-I-983

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<u>Inspection</u>	<u>Requirement paragraph</u>	<u>Test paragraph</u>
Group C (Cont'd)		
Depth charge (valves and rodmer only)	3.3	MIL-I-983
Supply line frequency variation	3.3	MIL-I-983
Supply line voltage	3.3	MIL-I-983

4.4.1 Sampling for quality conformance inspection. -

4.4.1.1 Group A examination on tests. - Each equipment shall be subjected to each group A examination and tests listed in 4.4 with acceptance based on 4.4.1.4.

4.4.1.2 Group B tests. - All equipments of the same design and manufactured at approximately the same time shall be considered a lot. From each lot a sample of equipments shall be selected in accordance with table 1. Each of the equipments so selected shall be subjected to all of the group B tests specified in 4.4. If any equipment fails in any group B test, all equipments in the lot shall be subjected to the tests and corrected as necessary to pass the tests.

Table 1 - Sampling for group B tests.

Lot size, number of lots on contract	Sample size, number of lots to be tested
2 to 5	1
6 to 9	2
10 to 15	3
16 to 25	5
26 to 40	7
41 to 65	10

4.4.1.3 Sampling for group C tests. - Group C tests shall be performed when the basic design of the equipment or the material of a vital part has been changed or when specified (see 6.1). One complete equipment shall be subjected to each of the group C tests specified in 4.4, with acceptance based on 4.4.1.5.

4.4.1.4 Acceptance - group A examination and tests. - The results of each examination and test shall be compared with specification requirements. Failure to conform to the specification requirements for any test shall be counted as a defect, and the equipment shall not be submitted for delivery.

4.4.1.5 Acceptance - group C tests. - The results of each test shall be compared with specification requirements. In the event of failure to conform to this specification for any group C test, the contractor shall correct the cause of failure in all equipments produced on the contract or order.

4.5 The attention of the manufacturer is invited to the applicable paragraphs of MIL-I-983 for information concerning the tests.

4.6 Test procedures. -

4.6.1 General examination. - The general examination shall be conducted in accordance with MIL-I-983. The operating test shall consist of:

- (a) Amplifier and indicator-transmitter. - Dummy signals from an appropriate power supply shall be injected into the circuit in such a manner that these units can be checked for normal operation from 0 to full scale at 4-knot intervals. The power supply for the dummy signals shall be such that the signal from the power supply will appear identical to the amplifier as that received from the rodmer during normal operation. The equipment shall be operated at each

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of these speeds for at least 10 minutes. During this test the equipment shall be checked for conformance with 3.4.1.2 and 3.4.1.4, speed of response, and other specification requirements specified in 3.5.2. Accuracy of distance conversion shall be checked by running at 5, 15, and 35 knots for 15 minutes each.

- (b) Rodmeter. - Each rodmeter shall be operated at least 30 minutes as specified in 4.6.2.2.1. Each rodmeter shall be static pressure tested to determine compliance with 3.3.4. The 200-p.s.i., 48-hour pressure test shall be applied to preproduction and group B samples only.
- (c) Seavalve. - Each seavalve shall be static pressure tested to determine compliance with 3.5.4. The 200-p.s.i., 48-hour pressure test shall be applied to preproduction and group B samples only.

4.6.2 Accuracy. -

4.6.2.1 Accuracy test (preproduction inspection). - The accuracy test shall consist of checking the equipment for conformance with 3.4 by means of calibration towing tests at a basin satisfactory to the bureau or agency concerned.

4.6.2.2 Accuracy test (quality conformance inspection). -

4.6.2.2.1 Rodmeter. - Each rodmeter shall be checked in a circulating water channel or in a water tank furnished by the contractor at a speed between 5 and 10 knots to insure conformance with 3.5.1.

4.6.2.2.2 System. - Each entire system shall be checked for conformance with performance tolerances specified in 3.4 by means of calibrated dummy speed signals.

4.6.3 Accelerated life. - The accelerated life test shall be conducted in accordance with MIL-I-983 with speeds of operation as follows:

<u>Hours</u>	<u>Speed</u>
0 - 100	1/4 full scale.
100 - 200	1/2 full scale.
200 - 300	3/4 full scale.
300 - 500	Varying from 0 to full scale and back to 0 at the rate of 1/4 knot per second.

5. PREPARATION FOR DELIVERY

5.1 Domestic shipment and early equipment installation and for storage of onboard repair parts. -

5.1.1 Underwater log equipment. -

5.1.1.1 Preservation and packaging. - Preservation and packaging shall be sufficient to afford adequate protection against corrosion, deterioration and physical damage during shipment from the supply source to the using activity and until early installation and may conform to the supplier's commercial practice when such meets these requirements.

5.1.1.2 Packing. - Packing shall be accomplished in a manner which will insure acceptance by common carrier and will afford protection against physical and mechanical damage during direct shipment from the supply source to the using activity for early installation. The shipping containers or method of packing shall conform to the Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation and may conform to the supplier's commercial practice when such meets these requirements.

5.1.1.3 Marking. - Shipment marking information shall be provided on interior packages and exterior shipping containers in accordance with the contractor's commercial practice. The information shall include nomenclature, contract or order number, contractor's name and destination.

5.1.2 Onboard repair parts. - Onboard repair parts shall be preserved and packaged level A; packed level C and marked levels A and C, respectively, in accordance with MIL-E-17555.

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5.2 Domestic shipment and storage or overseas shipment. - The requirements and levels of preservation and packaging, packing and marking for shipment shall be specified by the procuring activity (see 6.1).

(5.2.1 The following provides various levels for protection during domestic shipment and storage or overseas shipment which may be required when procurement is made (see 6.1).

(5.2.1.1 **Preservation, packaging, packing and marking.** - The equipment and accessories, repair parts and technical publications shall be preserved and packaged levels A or C; packed levels A or B as specified (see 6.1) and marked in accordance with MIL-E-17555.)

6. NOTES

6.1 Ordering data. - Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Components of system if other than as specified (see 3.2.1).
- (c) Quantity of onboard repair parts (see 3.3).
- (d) Inventory control point for repair parts (see 3.3).
- (e) Quantity of manuals required (see 3.3.7).
- (f) Type of rodmeeter required (see 3.5.1).
- (g) Whether hull bearing is required (see 3.5.4).
- (h) Quantity of items required.
- (i) Type and quantity of drawings required.
- (j) Whether group C tests are required (see 4.4.1.3).
- (k) Preservation and packaging, packing, and marking requirements if other than specified in 5.1 (see 5.2).

6.2 Preproduction. - Invitations for bids should provide that the Government reserves the right to waive the requirement for preproduction samples as to those bidders offering a product which has been previously procured or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending procurement.

Notice. - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in anyway be related thereto.

Preparing activity:
Navy - Ships
(Project 6320-N021Sh)

MIL-U-18033F(SHIPS)
AMENDMENT-2
28 July 1967
SUPERSEDING^{1/}
Amendment-1
12 April 1963

MILITARY SPECIFICATION

UNDERWATER LOG EQUIPMENT

ELECTROMAGNETIC TYPE

This amendment forms a part of Military Specification MIL-U-18033F(SHIPS), 20 November 1962.

- # Page 1, paragraph 2.1: Under "Specifications", "Military", "Standards", "Military", delete reference to "MIL-C-3655/2" and "MS3102", and, under "Specifications", "Military", add:

"MIL-B-23921 - Bronze. Nickel Aluminum Castings for Seawater Service".

- # Page 1, paragraph 2.1, continued: Under "Drawings" add:

"CHESAPEAKE INSTRUMENT CORPORATION

H3061 - Underwater Log Equipment (Electromagnetic Type) Outline and Installation

H3465 - Rodmeter Assembly IC/E-72-6F"

- # Page 2, paragraph 2.2: Delete:

"AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

B-148 - Specification for Aluminum Bronze Sand Castings."

- # Page 5, paragraph 3.4.1.2, line 3: Delete "5" and substitute "8".

1/ CHANGES FROM PREVIOUS ISSUE. THE OUTSIDE MARGINS OF THIS DOCUMENT HAVE BEEN MARKED "#" TO INDICATE WHERE CHANGES (DELETIONS, ADDITIONS, ETC.) FROM THE PREVIOUS ISSUE HAVE BEEN MADE. THIS HAS BEEN DONE AS A CONVENIENCE ONLY AND THE GOVERNMENT ASSUMES NO LIABILITY WHATSOEVER FOR ANY INACCURACIES IN THESE NOTATIONS. BIDDERS AND CONTRACTORS ARE CAUTIONED TO EVALUATE THE REQUIREMENTS OF THIS DOCUMENT BASED ON THE ENTIRE CONTENT AS WRITTEN IRRESPECTIVE OF THE MARGINAL NOTATIONS AND RELATIONSHIP TO THE LAST PREVIOUS ISSUE.

FSC 6320

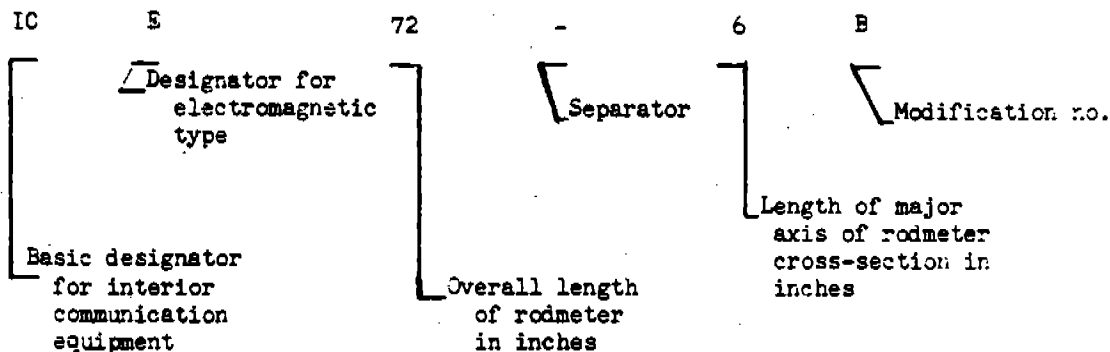
MIL-U-18033F(SHIPS)
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Page 5, paragraph 3.4.1.3: Delete and substitute:

"3.4.1.3 Distance indication. - The error of conversion from speed to distance from above 4 knots to full scale shall not exceed 1 percent of the distance traveled, and the error from speed to distance from 0.5 to 4 knots shall not exceed 2 percent of distance traveled."

Page 5, paragraph 3.5.1: Delete and substitute:

"3.5.1 Rodmeters. - Rodmeters shall be of the types designated in the following form, as specified (see 6.1):



Standard lengths for rodmetes shall be 72 and 100 inches. The contour of the rodmetet shall be in strict accordance with that shown on Drawing 3.215.217. Herringbone on the sensing element shall be eliminated. The top portion shall consist of a detachable watertight terminal box not over 5 inches in diameter, which will accommodate one cable connector for the cable from the rodmetet to the indicator-transmitter. The cover of this box shall be of sufficient strength to act as a positive stop against a bearing surface secured to the structure of the ship to prevent the rodmetet from being forced out of the seavalue extension. This box shall be removeable such that the rodmetet can be ejected outboard from the ship, if necessary. The box shall be rotatable through 180 degrees in either direction, and shall be equipped with a connector in accordance with Chesapeake Instrument Corporation Drawing 3465 through which connections to the pickup plates and electromagnet shall be made. The main body of the rodmetet shall be constructed of nickel-copper alloy, class A, in accordance with QQ-N-286 and provide a working strength of at least 65,000 p.s.i. in the outer fibers. The lower 12 to 13 inches of the rodmetet which contains the sensing element, shall be fabricated from a type 3 plastic embedding compound in accordance with MIL-I-16923. The shell of this plastic section shall be reinforced with a suitable glass fabric or glass roving. The rodmetet shall be designed so as

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to reduce to a minimum, the tendency to foul from seaweed and marine growth, and the necessity for withdrawal for repairs or cleaning. The rodmeter shall not bend or twist, when in maximum extended position, when used at the maximum speed and depth for which the equipment is designed. The embedded sensing element shall consist of an electromagnet having an impedance such that 750 ± 5 percent milliamperes flow through the coil when energized at 50 volts at 60 Hz. Under these operating conditions the rodmeter speed signal sensitivity, when measured at the pick-up buttons, shall be 325 ± 5 percent microvolts per knot. Quadrature or transformer voltage shall not exceed 50 microvolts. The pick-up plates in the sensing element of the rodmeter shall be constructed of material identical to that in the main body of the rodmeter, and shall be approximately $3/8$ inch in diameter. Throughout the speed range of 0 to 40 knots, the rodmeter shall not cavitate when operating in water at a depth of 3 feet."

Pages 5 and 6, paragraph 3.5.2: Delete and substitute:

"3.5.2 Indicator-transmitter.- The indicator-transmitter shall be of dripproof construction designed for bulkhead mounting, and shall have overall and mounting dimensions and cable connections shown on Chesapeake Instrument Corporation Drawing H3061. The indicator-transmitter shall be designed so that the internal units can be removed from the case or hinged to permit maintenance without disturbing the ship's wiring. Component subassemblies such as amplifiers shall be repairable and shall not be potted. Solid state devices shall be protected against transients of 3 milliseconds duration and 7 times their rated voltages. Adequate heat transfer provisions shall be made to permit full operation in ambient temperatures up through 149°F . Speed shall be indicated on a dial in accordance with figure 29 of Drawing 9000-S6504-73687, except that the dial diameter shall be $6-3/4$ inches. Distance shall be indicated by means of a six-digit counter from 0000.00 to 9999.99 nautical miles; the first four numerals shall be white on dull black background; the last two numerals (tenths and hundredths) shall be black on dull white background. Digits on the distance counter shall be at least $1/4$ inch high. These indications shall be visible through windows in the cover of the unit. The indicator-transmitter shall be designated type IT-C and shall comprise:

- (a) A feedback type servo system which shall convert the rodmeter speed voltage signal to visual indications of speed, and which shall position one type 37TRX6 to operate synchro repeaters at 40 knots per revolution, one type 18CX6 to transmit a speed signal of 100 knots per revolution, and three type 18CX4 synchros to transmit speed signals of 10, 40, and 100 knots per revolution to control transformers in navigation and fire control systems. Potentiometers used shall be dry, long life, precision type. The speed servo shall incorporate a device to permit changing the output response time from zero to full scale. The device

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shall have a manual-variable and an automatic variable mode of operation. Either mode of operation shall be selected by means of a switch which is accessible without removing the cover. In the manual variable mode of operation the output response time from zero to full scale shall be selected by means of a switch to be either 60 ± 10 seconds or $8 \pm 1/4$ minutes. In the automatic-variable mode of operation the output response rate shall be a function of speed error. If the absolute value of the indicated speed minus actual speed is less than 0.500 ± 10 percent knots the output rate of response shall be $8 \pm 1/2$ minutes for 0 to full scale. If the absolute value of the indicated speed minus actual speed is greater than 0.500 ± 10 percent knots the output rate of response shall be 60 ± 10 seconds for 0 to full scale. Also, the speed servo shall incorporate a hand crank to permit hand positioning the speed servo to any speed throughout the range of 0 to 40 knots.

- (b) A solid state integrator (no moving parts) shall convert the speed indication to electrical pulses proportional to distance traveled. The output of the integrator shall drive a servo system (step motor) which shall convert the pulse rate to visual indication of distance traveled (6076.10 foot/mile) and rotate a type 37TRK6 synchro at a rate of 360 revolutions per nautical mile.
- (c) Devices that can be adjusted to correct for errors, both constant and variable with speed, which may be caused by flow characteristics in the region of the rod-meter sensing element. This shall consist of nine devices which will compensate plus or minus 0.40 knot at 4., 8., 12., 16., 20., 24., 28., 32., and 36 knot scale positions independently and without interaction with each other. In addition, a device shall be provided to compensate plus or minus 1 knot for error indications at zero speed and a scale factor adjustment which can adjust the scale factor plus or minus 4 knots. Accuracy between dial calibration and correction entered shall be ± 1.0 percent.
- (d) A dummy signal circuit which can supply speed signals in lieu of the rod-meter to check system operation continuously from 0 to 40 knots. Provision shall be made whereby the dummy signal circuit can be remotely operated. The remote dummy log speed control unit shall be enclosed, and shall contain lamps to indicate when the unit is connected to control the speed indicated.
- (e) An amplifier unit as specified in 3.5.3.

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- (f) All synchro transmitters and control transformers shall be in accordance with MIL-S-20708 and MIL-STD-710.
- (g) A four-digit running time meter which will provide accumulated hours of services. The devices shall operate whenever the 60 Hz power is applied to the indicator-transmitter.
- (h) Unpotted repairable plug-in circuit cards shall be utilized in the design of the indicator-transmitter. (All electronic components.)
- (i) A device to provide the excitation current to the rodmeter type IC/E/72-6F of:
 - (1) For general application--0.750 amperes at 60 Hz.
 - (2) For MSO application--see Confidential Amendment to this specification."

Page 7: Delete figure 1.

Page 8, paragraph 3.5.4: Delete and substitute:

"3.5.4 Seavalue assembly (see 6.1).-

"3.5.4.1 Seavalue assembly (surface ships).- The seavalue assembly shall consist of a valve, a rodmeter packing or sealing gland, and a hull fitting or flange in accordance with Drawing 3,304,063. The main body of the seavalves shall be cast of aluminum bronze in accordance with MIL-B-23921. Repair of castings shall be in accordance with MIL-STD-278. The top cover piece for the rodmeter packing gland shall have a 3-inch cup-well designed to hold the rodmeter in alignment for passing into the packing gland, and to permit a small "alarm" stream of water to squirt up if a broken rodmeter should be withdrawn beyond the packing gland when the valve gate is still open. The hull fitting or flange shall be similar to the hull bearing specified herein, having a "cutlass" type bearing to cushion the rodmeter at the hull line. The seavalue, both opened and closed, shall withstand for 1 hour without leakage, deformation, or operational failure, a hydraulic pressure of 750 p.s.i. When both opened and closed the valve shall withstand a test pressure of 1500 p.s.i. In addition, the valve shall withstand the simulated depth charge test outlined in MIL-I-983. The seavalue shall be designated type SV-C.

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"3.5.4.2 Seavalue assembly (submarines). - The seavalue assembly shall consist of a valve, a rodmeter packing or sealing gland, and a hull fitting or flange in accordance with Drawing 3,304,063. The main body of the sea-valves shall be cast of nickel aluminum bronze in accordance with class 4 (heat treated) of MIL-B-16033. The nickel aluminum bronze shall contain a minimum of 4 percent nickel. Repair of castings shall be in accordance with MIL-STD-278. The top cover piece for the rodmeter packing gland shall have a 3-inch cup-well designed to hold the rodmeter in alignment for passing into the packing gland, and to permit a small "alarm" stream of water to squirt up if a broken rodmeter should be withdrawn beyond the packing gland when the valve gate is still open. The hull fitting or flange shall be similar to the hull bearing specified herein, having a "cutlass" type bearing to cushion the rodmeter at the hull line. An additional fitting, a hull bearing (see 6.1), shall be furnished. This bearing shall be of the "cutlass" bearing type, and shall be generally in accordance with Drawing 3,304,063. The seavalue, both opened and closed, shall withstand for 1 hour without leakage, deformation, or operational failure, a hydraulic pressure of 750 p.s.i. When both opened and closed the valve shall withstand a test pressure of 1500 p.s.i. In addition, the valve shall withstand the simulated depth charge test outlined in MIL-I-983. The seavalue shall be designated type SV-C. Each valve including the hull fitting shall be radiographed in accordance with MIL-STD-271. The valve shall have a by-pass feature to bleed pressure around the gate permitting unaided opening at full test pressure."

Page 11, paragraph 5.1.1.2, line 4: Delete "Unifrom" and substitute "Uniform".

Page 12, paragraph 6.1, item (g): Delete and substitute:

"(g) Whether hull bearing is required (see 3.5.4.2)."

Page 12, paragraph 6.1: Add as item (1):

"(1) Whether surface or submarine seavalue is required (see 3.5.4)."

Preparing activity:
Navy - SH
(Project 6320-N011)

RETAINER SHEET

MIL-U-18033F(SHIPS)

MILITARY SPECIFICATION
UNDERWATER LOG EQUIPMENT
ELECTROMAGNETIC TYPE

Amendment-3 to this specification contains information of a CONFIDENTIAL nature and is issued only upon specific request to the Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120. When requesting copies, state the purpose for which required.

Preparing activity:
Navy - SH

FSC 6320